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THE DYSENTERY BACILLUS GROUP AND THE VARIETIES WHICH SHOULD BE INCLUDED IN IT

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THE DYSENTERY BACILLUS GROUP AND THE VARIETIES WHICH SHOULD BE INCLUDED IN IT.[1]

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Shiga made known, in 1898, that in Japan there constantly occurred in dysenteric stools a bacillus not met with in normal stools or in ordinary diarrhea. This bacillus, though resembling in appearance and in growth on some media the colon bacillus, differed from it in many characteristics. It was not motile, produced no indol, and did not ferment with gas production any sugars. It usually agglutinated in high dilutions of the serum of patients convalescing from severe dysentery. Bacilli of apparently identical characteristics were later obtained from dysenteric stools in Europe, Asia, and America, so that when this investigation was undertaken most bacteriologists considered it established that this bacillus was the chief exciting factor in cases of acute epidemic dysentery not due to amebæ.

In 1900 Flexner and Strong, when in the Philippine Islands, isolated bacilli from dysenteric stools which they thought at that time to be identical with the Shiga cultures, but which were found later to differ in many characteristics. In the same year Kruse, in Germany, obtained from dysenteric cases in an asylum bacilli which appeared to him to be culturally like those isolated by Shiga, but to differ in their agglutinating characteristics. In 1902 Duval and Bassett, in Baltimore, found bacilli in the stools of a number of cases of summer diarrhea which later proved to be identical with the

[1] Read before the American Association of Pathologists and Bacteriologists, at its fourth annual meeting, New York, April 2, 1904.

[2] Dr. Collins was a Fellow of the Rockefeller Institute for Medical Research after October first, and as such aided in this investigation.

Flexner Manila culture. During the same summer Park and Dunham isolated a bacillus from a severe case of dysentery occurring during an epidemic at Seal Harbor, Mt. Desert, Maine, which they showed to differ[1] from the Shiga bacillus in that it produced indol in peptone solution and differed in agglutinating characteristics. They considered it at first to be identical with the Philippine culture given them by Flexner, but in January, 1903, it was shown by Park to be a distinct variety.

Martini and Lentz[2] published in December of 1902 the results of their work. They showed that the Shiga type of bacilli obtained from several separate epidemics in Europe agreed with the original Shiga culture in that it did not ferment the alcohol mannite. The cultures of this type agreed with each other in agglutinating characteristics. The bacilli from Flexner, Strong, Kruse, and others, which differed from the Shiga culture in their agglutinums, were all found to ferment mannite. Martini and Lentz, therefore, concluded that the Shiga bacillus was the true dysentery type and that the mannite fermenting variety or varieties might be mere saprophytes, or perhaps might be a factor in the less characteristic cases.

In January, 1903, Hiss[3] and Russell showed that a bacillus isolated by them from a dysenteric stool differed from Shiga's bacillus in the same characteristics as mentioned by Martini and Lentz.

At the beginning of the summer of 1903, therefore, it was recognized by many bacteriologists that there were in dysenteric stools at least two distinct types of bacilli: the true Shiga type and the type fermenting mannite and producing indol. It had also been established that the second type contained more than one variety.

The German observers considered the Shiga type as the only one which had established its causal relation to acute dysentery, while the American observers generally considered

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[1] N.Y. University Bulletin of the Med. Sciences, October, 1902, page 187.

[2] Zeitschrift f. Hygiene u. Infectionskrank, 1902, xli, 540 and 559.

[3] Medical News, 1903, lxxxii, 289.

both types to have equal standing and some[1] of them considered these differences as not important and perhaps not permanent. This latter opinion seems to have been held by Shiga.[2]

We began this investigation last summer with the object of carefully studying the bacilli isolated by us from the stools of persons suffering from acute dysentery, which occurred in a number of widely separated epidemics. We hoped thus to determine whether the bacilli exciting acute dysentery belonged to a few distinct types or were divided into a large number of varieties.

ORIGINAL INVESTIGATIONS.

The laboratory cultures studied came from the following sources: The Japan epidemic, 1898 (Shiga), the Philippine cases, 1900 (Flexner and Strong), the New Haven epidemic, 1901 (Duval), the Baltimore "summer diarrhea" cases, 1902 (Duval), the Seal Harbor epidemic, 1902 (Park), the Tuckahoe and Mt. Vernon epidemic, 1902 (Carey), New York City cases, 1902 (Wollstein). The new cultures isolated by us came from the epidemics in Mt. Vernon, Orange, Riker's Island, and Coney Island (1903), and from the sporadic cases of summer diarrhea and irregular types of dysentery in New York City (1903).

We will first consider the prevalence of the Shiga type of bacillus in the cases studied.

In the most extensive epidemic that has recently occurred in the region of New York City there were in all some five hundred cases of acute typical dysentery. Whole families were attacked with the disease.

The majority of the cases were of moderate severity, the dysenteric discharges lasting from one to two weeks. There were a number of light cases, but all had dysenteric stools containing mucus and blood. The mortality was about six per cent. Judging from the cases investigated by us, over one-half of those attacked seem to have been infected by the Shiga type

[1] University of Pennsylvania Medical Bul., July–August, 1903.

[2] Zeitschrift f. Hygiene u. Infectionskrank, 1902, xli, 356.

and these were, as a rule, the most severe cases. Most of the cases in two severe, though localized, epidemics in a Pennsylvania town and at Sheepshead Bay were also due to this type. The mortality was higher in these epidemics. As there is no question about the Shiga type being a factor in characteristic dysentery, no detailed clinical notes are given from the many cases from which cultures were isolated. The facts published abroad also indicate that this variety has been found in the chief epidemics in Europe and Asia. The bacilli isolated in the severe epidemic of dysentery reported by Vedder and Duval (at New Haven, Conn.) were chiefly of this type. We have not yet chanced to isolate bacilli which had all the characteristics of the Shiga variety from any diarrhea cases in which no dysenteric symptoms appeared.

We turn now to the mannite fermenting varieties, whose relationship to dysentery has been doubted by many.

The cultures isolated by us from over forty cases were found to fall largely into two distinct types, one of which differs from the Shiga bacillus more radically than the other.

The variety nearer to the Shiga bacillus has the characteristics of the culture, already mentioned, which was isolated by us at Seal Harbor, Maine, in August, 1902.

This bacillus differs from the Shiga bacillus in its agglutinating characteristics and in that it produces considerable indol in peptone solution and ferments mannite with the production of acids. It differs from the Flexner Philippine type in its agglutinating characteristics and in that it does not ferment saccharose or chemically pure maltose in peptone solution.

Besides the epidemic at Seal Harbor, numerous cases of moderately severe or slight dysentery due to this type were met with in the extensive epidemic which has been already alluded to in the towns north of New York City. The few characteristic, as well as the more numerous less marked, cases of dysentery in New York City during the past summer

were, in the majority of instances, infected with this type. In many stools no blood was noticed.

Histories of three cases of dysentery, typical of those infected with this type, will suffice to illustrate, and are as follows:

Case 1. A woman, age forty-three, eight fluid passages containing mucus and large amounts of blood daily. Some abdominal pain and tenesmus. On sixth day she was practically well, the stools being free of mucus and blood.

Case 2. A man, age seventy-two, sick twenty-four hours. Temperature 103, pulse 105, considerable prostration and abdominal pain. Sixteen fluid bloody stools in first twenty-four hours. At end of week he was sitting up and feeling well.

Case 3. A child, age three, stools every two hours were thin and watery and contained mucus and blood. Vomiting was frequent, and tenesmus considerable.

In these three cases about 10 per cent of the bacilli in the cultures from the stools were of the Seal Harbor type, and no other types of dysentery bacilli were found. Numerous other cases had similar mild or moderate symptoms. A mild case in a young child was of considerable interest. From straining there was slight prolapse of the mucous membrane. This was deeply injected and covered with mucus. A little of this mucus was taken and cultures made. Almost a pure culture of the Seal Harbor type was obtained, there being practically no other bacilli present. It is an interesting fact that, although in the same towns both types of bacilli were causing infection, we never found the Seal Harbor type associated with the Shiga type in any case. It seems as if the variety first causing infection usually greatly predominates in numbers over a second, if it should be added.

The third type of dysentery bacilli (Flexner Philippine type), as already stated, not only produces indol and ferments mannite, it also rapidly ferments maltose with the production of acid in peptone solution and attacks saccharose under favorable conditions.

The Philippine culture of Flexner, the Baltimore culture of Duval, and New York City cultures of Wollstein belong to this group. During the past year epidemics of dysentery at Riker's Island and Orange have been investigated by us, in which this type of dysentery bacillus was the only one met with in the stools. Some isolated, mild, and irregular cases have also been met with in New York City. A few histories

will demonstrate that epidemics of acute typical dysentery may be caused by this type of bacillus. A number of rather severe cases of dysentery developed in Orange, N.J., during the past summer. Cultures from two cases were made, and this Philippine type alone obtained. The following is a typical case. Eighteen out of thirty colonies, selected from the plates, when tested proved to be dysentery bacilli.

Dorothy D., two and one-fourth years. Seen first July 29. The day before the child had eaten green apples. Previous to this the child had had an attack of vomiting and diarrhea, the sickness lasting two weeks, the diarrhea had subsided only two days before present illness. No blood was seen during this first attack. When first seen, the child had a temperature of 104.6 with vomiting and diarrhea. After a calomel purge the patient was better; the following day, however, the diarrhea started up again and the temperature rose. The stools were numerous, small, containing mucus and blood, preceded by pain and accompanied by tenesmus. Many of the stools consisted of nothing but blood and mucus. Sixteen movements was the greatest number recorded in a day. On August 2 ten cubic centimeters of-dysenteric serum was injected. There seemed to be some improvement in the character of the stools following the injection. On August 4th and 6th the injections were repeated, being followed each time, apparently, by some improvement in the child's condition. The blood disappeared in eight or nine days, and the child had then five movements daily, consisting largely of mucus.

At Riker's Island a number of men were filling in new land. Dysentery broke out and spread to a number of the men, as well as to the physician in charge. Those infected had usually a short, sharp attack with a quick recovery. Very large amounts of blood were passed by some of the sick. In some a large proportion of the bacteria isolated were bacilli of the Philippine type. No other type of dysentery bacilli was found in any of the cases in this epidemic.

The above statements seem to us to be sufficient to establish that there are at least three distinct types of bacilli which are factors in epidemic dysentery. Or we might divide them into two groups, the true Shiga group and the group of mannite fermenters. The latter group being divided into two types, one fermenting mannite alone in peptone solution, the

other maltose and saccharose also. When the agglutinating characteristics of these bacilli and their susceptibility to immune sera are studied carefully, we find that each of the three types differs from the others. Here again the mannite and the maltose types, through their stimulating in animals abundant common agglutinins and immune bodies, seem more closely allied to each other than to the Shiga type.

This is seen in the following tables in which bacilli from a number of cases obtained from different sources are tested in sera from animals which have each received a single type of dysentery bacillus.

The technic used in making the agglutination tests was as follows: Bouillon was inoculated with the bacilli from eighteen-hour old agar cultures and allowed to stand for two hours at 37° C. To prepare the hanging drops the bouillon culture was added to an equal quantity of the diluted serum. The hanging drops were kept at a temperature of about 22° to 25° C. and examined at the end of three hours under the microscope. Control tests were made in tubes and yielded similar results, except that the incomplete reactions could not be so well noted. On different days the same serum was found to give slightly different results, higher dilutions acting on some days than on others. For this reason each serum was tested on all the bacilli at the same time.

TABLE I.

Agglutination of bacilli belonging to the three types in the serum of a young goat injected with the bacillus isolated by Shiga, in Japan.

Source. Isolated by	Dilutions of Serum.									
	1: 10	1: 20	1: 50	1: 100	1: 200	1: 500	1: 1000	1: 2000	1: 3000	1: 5000
Type I. Shiga.										
1. Original, Japan — Shiga	++	++	++	++	++	++	++	++	+|	+
2. New Haven — Duval	++	++	++	++	++	++	++	++	+|	+
3. Tuckahoe — Carey	+|	+|	++	++	++	++	++	+|	+|	±
4. Coney Island — Collins	++	++	++	++	++	++	++	++	+	+
5. Mt. Vernon, Case I. — Collins .	++	++	++	++	++	++	++	+|	+	+
6. " " " II. — " . .	+|	++	++	++	++	++	++	++	+	±
7. " " " III. — " . .	++	++	++	++	++	++	++	+	+	±
Type II.										
8. Original, Mt. Desert — Park . .	++	+|	+|	|						
9. New York City — Goodwin . . .	++	+|	+|	|						
10. Hospital, N.Y. — Collins	+|	+|	+|	|						
11. Foundling Hospital — Hiss . . .	++	+|	+|	|						
12. Mt. Vernon, Case I. — Collins .	++	+|	|							
13. " " " II. — " . .	++	++	+|							
Type III.										
14. Original, Manila — Flexner . .	++	+	+	+	±					
15. Baltimore — Duval	++	+|	+|	+	±					
16. New York City — Wollstein . .	++	++	+	±	|					
17. Orange — Collins	++	+	+	±						
18. Riker's Island — Goodwin . . .	++	++	++	+	|					

The serum of this goat before injection did not agglutinate any of the above bacilli in a 1: 10 dilution.

++ = complete reaction. + = good reaction. | = slight reaction.
+| = very good reaction. ± = fair reaction. — = no reaction.

TABLE II.

Showing agglutination of members of three types in the serum of animals injected with bacilli of Type II.

Source. Isolated by	Goat Injected with No. 6.						Rabbit Injected with No. 8.					
	1:20	1:50	1:100	1:500	1:1000	1:5000	1:20	1:50	1:100	1:500	1:800	1:1000
Type I. Shiga.												
1. Japan — Shiga	+	—	—	—	—	—		—	—	—	—	—
2. New Haven — Duval,	+	—	—	—	—	—		—	—	—	—	—
3. Tuckahoe — Carey . .	+	—	—	—	—	—		—	—	—	—	—
4. Mt. Vernon — Collins,	+	—	—	—	—	—		—	—	—	—	—
5. Brooklyn — Collins .	+	—	—	—	—	—		—	—	—	—	—
Type II.												
6. Mt. Desert — Park .	++	++	++	++	++	—	++	++	++	+		—
7. New York — Wollstein	++	++	++	++	++	—	++	++	++	+		—
8. Mt. Vernon — Collins,	++	++	++	++	++	—	++	++	++	+	+	—
9. New York — Hiss . .	++	++	++	++	++	—	++	++	++	+	—	—
Type III.												
10. Manila — Flexner . .	++	++	+	—	—	—	++	++	++	—	—	—
11. Baltimore — Duval .	++	++	+	—	—	—	++	++	++	—	—	—
12. New York — Wollstein	++	++	+	—	—	—	++	++	++	—	—	—
13. Orange — Collins . .	++	++	+	—	—	—	++	++	++	—	—	—
14. Riker's — Goodwin .	++	++	+	—	—	—	++	++	++	—	—	—

The serum of the above animals did not agglutinate any of the above bacilli in a 1:20 dilution.

TABLE III.

Showing agglutinating differences between bacilli of Type II., which agree in their fermentation of sugars.

Reactions of members of three types in serum of animals injected with Type II., B. Rabbit injected with Brooklyn, Collins.

	1:10	1:20	1:50	1:100	1:500	1:1,000
Type I.						
5 Shiga type cultures	—	—	—	—	—	—
Type II.						
Mt. Desert — Park	++	++	+	—	—	—
New York — Wollstein	++	++	+	—	—	—
Mt. Vernon — Collins	++	++	+	—	—	—
New York — Hiss	++	++	+	—	—	—
Type II., Class B.						
Brooklyn — Collins	++	++	++	++	+	—
Type III.						
Manila	++	++	—	—	—	—
Baltimore	++	++	—	—	—	—
New York	++	++	—	—	—	—
Orange	++	++	—	—	—	—
Riker's	++	++	—	—	—	—

This is an example of an occurrence that we have met with a number of times in testing the sera of rabbits inoculated with bacilli from isolated cases which showed, when tested in the sera specific for the three main types, a slight difference from any of them. This was found to depend upon the production of truly specific agglutinins along with group agglutinins.

TABLE IV.

Showing agglutinations of members of three types in the serum of animals injected with bacilli of Type III.

	Rabbit Injected with Baltimore, Duval.									Rabbit Injected with Riker's Island.					
	10	20	50	100	500	1,000	5,000	7,500	10,000	10	20	50	100	200	500
Type I.															
1. Japan—Shiga	++	++	+	+	—	—	—	—	—	—	—	—	—	—	—
2. Tuckahoe—Carey	++	++	+	—	—	—	—	—	—	—	—	—	—	—	—
3. New Haven—Duval	++	+		—	—	—	—	—	—	—	—	—	—	—	—
4. Mt. Vernon—Collins	++	++	+		—	—	—	—	—	—	—	—	—	—	—
5. Brooklyn—Collins	++	+		—	—	—	—	—	—	—	—	—	—	—	—
Type II.															
6. Mt. Desert—Park	++	++	++	+	—	—	—	—	—	++	—				
7. New York—Collins	++	++	++	+	—	—	—	—	—	++	—				
8. Mt. Vernon—Collins	++	++	++	+	—	—	—	—	—	++	—				
9. New York—Hiss	++	++	+		—	—	—	—	—	++	—				
Type III.															
10. Manila—Flexner	++	++	++	++	++	++	++	+	+	++	++	++	++	+	—
11. Baltimore—Duval	++	++	++	++	++	++	++	+	+	++	++	++	++	+	—
12. New York—Wollstein	++	++	++	++	++	++	++	+	+	++	++	++	++	+	—
13. Orange—Collins	++	++	++	++	++	++	++	+	+	++	++	++	++	+	—
14. Riker's Island—Goodwin	++	++	++	++	++	++	++	+	+	++	++	++	++	+	—

The serum of the Baltimore rabbit agglutinated the bacilli of Type III. in 1:20 dilution, but none of the others even in 1:10. This is one of the few animals in which agglutinins for Type I. developed through the injections of bacilli of the other types.

TABLE V.

Showing how Type III. is unable to absorb the agglutinins produced through injections of Type II. Serum from rabbit inoculated with Mt. Vernon culture, Type II.

	Serum before Absorption.	Agglutinins Exhausted with							
		Duval Baltimore.					Mt. Vernon cc.$_2$		
		1:20	1:50	1:100	1:200	1:400	1:20	1:50	1:100
Type I.									
Shiga, 5 cultures . .	1:10	—	—	—	—	—	—	—	—
Type II.									
Mt. Desert	1:600	++	++	++	+|	|	—	—	—
New York	1:600	++	++	++	+|	—	—	—	—
Mt. Vernon	1:600	++	++	++	+|	—	—	—	—
New York	1:600	++	++	++	+|	—	—	—	—
Type III.									
Manila	1:100	—	—	—	—	—	++	|	—
Baltimore	1:100	—	—	—	—	—	++	—	—
New York	1:100	—	—	—	—	—	++	—	—
Orange	1.100	—	—	—	—	—	+|	—	—
Riker's	1:100	—	—	—	—	—	+|	—	—

Before injections this rabbit's serum agglutinated Types II. and III. in 1:20 dilutions.

The considerable amount of common agglutinins affecting Type II. and Type III. are seen to be absorbed by the bacilli of either type. The larger amount of specific agglutinin is left in the serum when any bacillus other than one of identical characteristics with the bacillus used in the immunization is employed.

TABLE VI.

Showing that horse injected with Shiga and Philippine types developed specific agglutinins for the bacilli belonging to these two types and common agglutinins for the varieties included unaer Type II.

Cultures.	Serum after Injections for Several Months.	Same Serum after Saturation with Cultures of						
		Shiga Type.	Type III.	Type II.	Staphylococcus.	Pyocyaneus.	Typhoid.	Colon.
Type I.								
Shiga Original .	+1,500	—10	+400	+700	+150	+1,000	+300	+300
New Haven . . .	+1,500	—10	+400	+700	+150	+800	+250	+300
Mount Vernon .	+1,500	—10	+400	+700	+150	+700	+250	+300
Tuckahoe	+1,500	—10	+400	+700	+150	+800	+250	+300
Brooklyn	+1,500	—10	+400	+700	+150	+800	+300	+300
Type II.								
Park Original . .	+600	—10	—10	—10	+600	+600	+30	+50
New York City .	+600	—10	—10	—10	+600	+600	+30	+40
New York Hiss .	+600	—10	—10	—10	+600	+600	+30	+40
Mount Vernon .	+600	—10	—10	—10	+600	+800	+30	+40
NewYork City .	+600	—10	—10	—10	+600	+600	+30	+50
Type II. (B).								
Brooklyn	+600	+20	+10	+50	+200	+300	+100	+50
Type II. (C).	+300	—10	—10	+50	+100	+50	+10	+20
Type II. (D).	+600	—20	—10	+50	+100	+100	+30	+60
Type III.								
Flexner Original,	—1,200	+400	—10	+500	+800	+800	+300	+600
Baltimore	+1,200	+400	—10	+500	+800	+1,000	+300	+400
New York City .	+1,200	+400	—10	+500	+800	+800	+400	+500
Orange	+1,200	+400	—10	+500	+800	+800	+300	+400
Riker's Island . .	+1,200	+400	—10	+500	+800	+1,000	+300	+600

The manipulation necessary in making dilutions and filtering, as well as the effect of standing, cause a certain amount

of destruction of agglutinins. The marked reduction of agglutinins for the Shiga type after saturation with staphylococci is probably due to a destructive action.

TABLE VII.

Protective action of serum of dysentery horses at an early period in the process of immunization.

	Fatal dose.	Shiga Horse.		Type III. Horse.	
		Protected.	Unprotected.	Protected.	Unprotected.
Shiga Type.....	2 loops	4 loops	6 loops	*	* 2 loops
Type III.....	4 "	.....	4 "	8 loops	12 "
Type II., Class A.....	½ "	.....	½ "	½ "	2 "
Type II., Class B.....	1 "	.....	1 "	2 "	
Type IV., normal case..	½ "	.....	½ "	.....	½ "
Colon Bacillus γ	4 "	.....	4 "	4 "	8 "

*This test was one with the serum of a goat immunized to Type III.

After a longer period of inoculations the serum of the horse immunized to the Shiga type had distinct protective value in preventing infection with the acid types. The reverse was also true, that the serum of animals receiving repeated injections of the acid types finally protected the Shiga type.

The serum of animals injected with acid Type III. acted nearly as powerfully on acid Type II. as on its own type. Animals injected with cultures obtained from normal cases, which varied only slightly in their cultural reactions, were not protected by the dysenteric serum. Most colon bacilli were also not acted upon by any dysenteric serum.

A member of the colon group obtained from several cases, which in its fermentative action upon sugars was identical with characteristic colon cultures, was found to produce through its injections in animals abundant agglutinin for Type III. Type III. also produced abundant agglutinin for the colon culture.

The same reciprocal relations were found to exist between them in immune bodies. This colon bacillus was found in several cases of atypical dysentery, especially of a chronic type.

SUMMARY AND CONCLUSIONS.

The great majority of the bacilli which have been isolated from cases of dysentery not due to amebæ, and which must be considered as being exciting factors in that disease, are included in three distinct varieties or types. This at least is true for the many cultures which we have isolated or obtained from others.

The type most frequently found in severe epidemics is that of the first culture isolated by Shiga. Bacilli identical in bio-chemical and agglutinating characteristics with this bacillus have been isolated from cases of dysentery in many parts of the world. None of the bacilli belonging to this type produce indol, except, perhaps, in a trace, or ferment mannite, maltose, or saccharose. Animals injected with this type produce specific agglutinins for this type in abundance and only very little that combines with the others.

The second type ferments mannite with the production of acid, but does not split maltose or saccharose in peptone solution or agar.

It produces indol. Animals, after inoculation with it, develop immune bodies and agglutinins specific for the type. They also develop in considerable proportion immune bodies and agglutinins which have affinity for the bacilli of Type III. and to a slight extent for Type I.

The third type is nearest to the colon group, since it not only produces indol and actively ferments mannite, but also acts energetically upon pure maltose and feebly upon saccharose.

Animals injected with this type develop specific immune bodies and agglutinins and also abundant immune bodies and agglutinins which have an affinity for the bacilli of Type II. and for many bacilli of the colon group. For Type I. these substances are but slightly developed.

These two mannite fermenting types are widely scattered over the world, and certainly cause characteristic cases and epidemics of dysentery, although on the average the disease caused by them is milder than when due to the Shiga bacillus. One or the other of these two types also appear at times in small numbers in mixed infections where dysenteric symptoms are almost or entirely absent.

Although the majority of bacilli obtained have had the characteristics of one of the above types, still bacilli have been found in isolated cases, which, although agreeing in bio-chemical characteristics with one of the three, nevertheless differed in producing different specific agglutinins. A few bacilli have also been met with which differ slightly in bio-chemical as well as agglutinating characteristics.

It seems, therefore, that these three types should be considered as the characteristic representatives of three groups.

In consideration of all the above facts, it seems to us incorrect to name the mannite fermenting groups as pseudo dysentery bacilli. If we call them all dysentery bacilli, we must classify them as dysentery bacilli of the Shiga group, of the group fermenting mannite but not maltose, and of the one fermenting both mannite and maltose.

This manner of differentiating the groups would be very confusing and it seems to us more convenient, and better, to restrict the name dysentery to bacilli having the characteristics of the bacillus isolated by Shiga, and give the name para-dysentery to the other two groups which approach more closely the colon group in that they produce indol and have a greater range of activity in fermenting carbo-hydrates.

An additional reason for the use of the prefix para, beyond that of convenience, is the less average severity of the disease due to these types and the probability that there will be found, in occasional sporadic cases and epidemics of dysentery, bacilli which have a causal relation to dysentery and exhibit more pronounced characteristics of the colon group than any of the varieties so far isolated.